Compact and Upright
Water Temperature Control Units

Models Covered:
TrueTemp TCU, CWT, Royal Series 2010/2012

Part Number: 882.12041.00
Bulletin Number: WTR1-605
Effective: August 1, 2012

an ACS Group company

Write Down Your Serial Numbers Here For Future Reference:

_____ _____

_____ _____

_____ _____

We are committed to a continuing program of product improvement.
Specifications, appearance, and dimensions described in this manual are subject to change without notice.

DCN No. _____
© Copyright 2012
All rights reserved.

Shipping Info

Unpacking and Inspection

You should inspect the water temperature control unit for possible shipping damage. Thoroughly check the equipment for any damage that might have occurred in transit, such as broken or loose wiring and components, loose hardware and mounting screws, etc.

In the Event of Shipping Damage

According to the contract terms and conditions of the Carrier, the responsibility of the Shipper ends at the time and place of shipment.

Notify the transportation company's local agent if you discover damage.

Hold the damaged goods and packing material for the examining agent's inspection. Do not return any goods before the transportation company's inspection and authorization.

File a claim with the transportation company. Substantiate the claim by referring to the agent's report. A certified copy of our invoice is available upon request. The original Bill of Lading is attached to our original invoice. If the shipment was prepaid, write us for a receipted transportation bill.

Advise customer service regarding your wish for assistance and to obtain an RMA (return material authorization) number.

If the Shipment is Not Complete

Check the packing list as back-ordered items are noted on the packing list. You should have:

- ☑ Water Temperature Control Unit
- ☑ Bill of lading
- ☑ Packing list
- ☑ Operating and Installation packet
- ☑ Electrical schematic and panel layout drawings
- ☑ Component instruction manuals

Re-inspect the container and packing material to see if you missed any smaller items during unpacking.

If the Shipment is Not Correct

If the shipment is not what you ordered, **contact the shipping department immediately**. For immediate assistance, please contact the correct facility located in the technical assistance section of this manual. Have the order number and item number available. *Hold the items until you receive shipping instructions*.

Returns

Do not return any damaged or incorrect items until you receive shipping instructions from the shipping department.

Credit Returns

Prior to the return of any material **authorization** must be given by **the manufacturer.** A RMA number will be assigned for the equipment to be returned.
Reason for requesting the return must be given.

ALL returned material purchased from **the manufacturer** returned is subject to 15% ($75.00 minimum) restocking charge.

ALL returns are to be shipped prepaid.

The invoice number and date or purchase order number and date must be supplied.

No credit will be issued for material that is not within the manufacturer's warranty period and/or in new and unused condition, suitable for resale.

Warranty Returns

Prior to the return of any material, authorization must be given by **the manufacturer.** A RMA number will be assigned for the equipment to be returned.

Reason for requesting the return must be given.

All returns are to be shipped prepaid.

The invoice number and date or purchase order number and date must be supplied.

After inspecting the material, a replacement or credit will be given, at **the manufacturer's** discretion. If the item is found to be defective in materials or workmanship, and it was manufactured by our company**,** purchased components are covered under their specific warranty terms.

Table of Contents

Shipping Info 3

Chapter 1:Safety 7

1-1 How to Use This Manual 7
Safety Symbols Used in this Manual 8
1-2 Warnings and Precautions 9
1-3 Responsibility 10

Chapter:2 Functional Description 14

2-1 Introduction 14
2-2 Necessary Documents 15
2-3 Models Covered 15
2-4 Standard TCU Series Features 15
2-5 Available Options 16

Chapter:3 Installation 20

3-1 Installation Location Considerations 20
3-2 Process Approach Temperature Considerations 20
3-3 External Piping Sizing Considerations 20
3-4 Piping Considerations for Permanent Installations 21
3-5 Piping Considerations for High Mobility Installations 22
3-6 Process Water Considerations 22
3-7 Making Process Water Connections 23
3-8 Making Cooling Water Connections 24
3-9 Making System Purge Connections 25
3-10 Making Electrical Connections 27

Chapter:4 Identifying Controls and Features 30

4-1 Identifying Mechanical Controls and Features 30
4-2 Motorized Modulating Valves 32
4-3 Water Hammer Arrestor (Shock Stop) 32
4-4 The Microprocessor Controller 33
4-5 Controller Display 34
4-6 Digital Flow Meter 35
4-7 Identifying Graphic Panel Indicators 36
4-8 Using Graphic Panel Buttons 38
4-9 Alarms 39
4-10 Controller Internal Switches 39
4-11 Communications 39

Chapter:5 Startup and Operation 40

5-1 Introduction 40
5-2 Startup Checklist 40

5-3 Starting the Temperature Control Unit 41
5-4 Sequence of Operation 42
5-5 Checking Motor Rotation Direction 43
5-6 Shutting Down the Temperature Control Unit 43

Chapter:6 Unit Maintenance 45

6-1 Preventive Maintenance 45
6-2 Corrective Maintenance 46
6-4 Electrical Connections 48
6-5 Safety Devices 48
6-6 Cleaning and Storage 51

Chapter:7 Troubleshooting..... 52

Technical Assistance 57
Parts and Service Department 57
Sales and Contracting Department 57

Chapter 1:Safety

1-1 How to Use This Manual

Use this manual as a guide and reference for installing, operating, and maintaining the water temperature control unit. The purpose is to assist you in applying efficient, proven techniques that enhance equipment productivity.

This manual covers only light corrective maintenance. No other maintenance should be undertaken without first contacting a service engineer.

The Functional Description section outlines models covered, standard features, and safety features. Additional sections within the manual provide instructions for installation, pre-operational procedures, operation, preventive maintenance, and corrective maintenance.

The Installation chapter includes required data for receiving, unpacking, inspecting, and setup of the Compact and Upright Series temperature control unit. We can also provide the assistance of a factory-trained technician to help train your operator(s) for a nominal charge. This section includes instructions, checks, and adjustments that should be followed before commencing with operation of the temperature control unit. These instructions are intended to supplement standard shop procedures performed at shift, daily, and weekly intervals.

The Operation chapter includes a description of electrical and mechanical controls, in addition to information for operating the temperature control unit safely and efficiently.

The Maintenance chapter is intended to serve as a source of detailed assembly and disassembly instructions for those areas of the equipment requiring service. Preventive maintenance sections are included to ensure that the temperature control unit provides excellent, long service.

The Troubleshooting chapter serves as a guide for identification of most common problems. Potential problems are listed, along with possible causes and related solutions.

The Appendix contains technical specifications, drawings, schematics, parts lists, and available options. A spare parts list with part numbers specific to your machine is provided with your shipping paperwork package. Refer to this section for a listing of spare parts for purchase. Have your serial number and model number ready when ordering.

Safety Symbols Used in this Manual

The following safety alert symbols are used to alert you to potential personal injury hazards. Obey all safety messages that follow these symbols to avoid possible injury or death.

⚠ DANGER — ***DANGER indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.***

⚠ WARNING — ***WARNING indicates a potentially hazardous situation or practice that, if not avoided, could result in death or serious injury.***

⚠ CAUTION — ***CAUTION indicates a potentially hazardous situation or practice that, if not avoided, may result in minor or moderate injury or in property damage.***

Temperature control unit Safety Tags

Hazard Alert Symbol	Description/Explanation	Preventative Maintenance
	High Voltage Hazard. The electrical enclosure is supplied with 3-phase electrical power. Use caution when using or maintaining this product.	Every six months inspect all electrical connections for secure attachment. For further information see the Maintenance Chapter in this manual
	Hot Surface Hazard. When the unit operates above 212F (100C) the surface of the unit may reach excessive temperatures. Use caution when using or maintaining this product.	Every six months inspect all surfaces for signs of heat degradation. If any appear remove panel and verify cause of degradation and repair.
Mandatory Symbol	Description/Explanation	
	Read Operators Manual. This equipment must be operated and maintained by properly trained personnel. The information contained within this manual must be read and understood prior to operating this equipment.	
	Lock Out. This equipment is operated with 3-phase electrical power. Therefore, when performing any maintenance operations we recommend following the local standards for performing a lock-out/tag-out procedure.	
	Wear Safety Gloves. This equipment operates above 212F (100C) and its surfaces may reach excessive temperatures. We recommend that technicians use safety gloves while performing maintenance to protect hands from being exposed to these hot surfaces.	

1-2 Warnings and Precautions

Our equipment is designed to provide safe and reliable operation when installed and operated within design specifications, following national and local safety codes. This may include, but is not limited to OSHA, NEC, CSA, SPI, and any other local, national and international regulations.
To avoid possible personal injury or equipment damage when installing, operating, or maintaining this equipment, use good judgment and follow these safe practices:

- ☑ **Read and follow these operation and installation instructions when installing, operating, and maintaining this equipment. If these instructions become damaged or unreadable, additional copies are available from the manufacturer.**
- ☑ Follow all **SAFETY CODES**.

- ☑ Wear **SAFETY GLASSES** and **WORK GLOVES**.
- ☑ Work only with approved tools and devices.

- ☑ Disconnect and/or lock out power before servicing or maintaining the equipment.
- ☑ Use care when **LOADING, UNLOADING, RIGGING**, or **MOVING** this equipment.
- ☑ Operate this equipment within design specifications.

- ☑ **OPEN, TAG**, and **LOCK ALL DISCONNECTS** before working on equipment. You should remove the fuses and carry them with you.
- ☑ Make sure the equipment and components are properly **GROUNDED** before you switch on power.
- ☑ When welding or brazing in or around this equipment, make sure **VENTILATION** is **ADEQUATE. PROTECT** adjacent materials from flame or sparks by shielding with sheet metal. An approved **FIRE EXTINGUISHER** should be close at hand and ready for use if needed.
- ☑ Do not restore power until you remove all tools, test equipment, etc., and the equipment and related components are fully reassembled.
- ☑ Only **PROPERLY TRAINED** personnel familiar with the information in this manual should work on this equipment.

We have long recognized the importance of safety and have designed and manufactured our equipment with operator safety as a prime consideration. We expect you, as a user, to abide by the foregoing recommendations in order to make operator safety a reality.

1-3 Responsibility

These machines are constructed for maximum operator safety when used under standard operating conditions and when recommended instructions are followed in the maintenance and operation of the machine.
All personnel engaged in the use of the machines should become familiar with their operation as described in this manual.
Proper operation of the machine promotes safety for the operator and all workers in its vicinity.

Each individual must take responsibility for observing the prescribed safety rules as outlined. All warning and danger signs must be observed and obeyed. All actual or potential danger areas must be reported to your immediate supervisor.

General Responsibility

No mater who you are, safety is important. Owners, operators and maintenance personnel must realize that every day, safety is a vital part of their jobs.
If your main concern is loss of productivity, remember that production is always affected in a negative way following an accident. The following are some of the ways that accidents can affect your production:

- Loss of a skilled operator (temporarily or permanently)
- Breakdown of shop morale
- Costly damage to equipment
- Downtime

An effective safety program is responsible and economically sound.
Organize a safety committee or group, and hold regular meetings. Promote this group from the management level. Through this group, the safety program can be continually reviewed, maintained, and improved. Keep minutes or a record of the meetings.

Hold daily equipment inspections in addition to regular maintenance checks. You will keep your equipment safe for production and exhibit your commitment to safety.
Please read and use this manual as a guide to equipment safety. This manual contains safety warnings throughout, specific to each function and point of operation.

Operator Responsibility

The operator's responsibility does not end with efficient production. The operator usually has the most daily contact with the equipment and intimately knows its capabilities and limitations.
Plant and personnel safety is sometimes forgotten in the desire to meet incentive rates, or through a casual attitude toward machinery formed over a period of months or years. Your employer probably has established a set of safety rules in your workplace. Those rules, this manual, or any other safety information will not keep you from being injured while operating your equipment.

Learn and always use safe operation. Cooperate with co-workers to promote safe practices. Immediately report any potentially dangerous situation to your supervisor.

- **NEVER** place your hands or any part of your body in any dangerous location.
- **NEVER** operate, service, or adjust the temperature control unit without appropriate training and first reading and understanding this manual.
- **NEVER** try to pull material out of the temperature control unit with your hands while it is running!
- Before you start the temperature control unit, check the following:
    - Remove all tools from the temperature control unit;
    - Be sure no objects (tools, nuts, bolts, clamps, bars) are laying in the area;
- If your temperature control unit has been inoperative or unattended, check all settings before starting.
- At the beginning of your shift and after breaks, verify that the controls and other auxiliary equipment are functioning properly.
- Keep all safety guards in place and in good repair. **NEVER** attempt to bypass, modify, or remove safety guards. Such alteration is not only unsafe, but will void the warranty on your equipment.
- When changing control settings to perform a different mode of operation, be sure selector switches are correctly positioned. Locking selector switches should only be adjusted by authorized personnel and the keys removed after setting.
- Report the following occurrences **IMMEDIATELY:**
    - unsafe operation or condition
    - unusual temperature control unit action
    - leakage
    - improper maintenance
    - **NEVER** stand or sit where you could slip or stumble into the temperature control unit while working on it.
- **DO NOT** wear loose clothing or jewelry, which can be caught while working on the temperature control unit. In addition, cover or tie back long hair.
- Clean the temperature control unit and surrounding area **DAILY**, and inspect the machine for loose, missing or broken parts.
- Shut off power to the temperature control unit when it is not in use. Turn the switch to the **OFF** position, or unplug it from the power source.

⚠CAUTION

Maintenance Responsibility

Proper maintenance is essential to safety. If you are a maintenance worker, you must make safety a priority to effectively repair and maintain equipment.
Before removing, adjusting, or replacing parts on a machine, remember to turn off all electric supplies and all accessory equipment at the machine, and disconnect and lockout electrical and pneumatic power. Attach warning tags to the disconnect switch and air shutoff valve.

When you need to perform maintenance or repair work on a temperature control unit above floor level, use a solid platform or a hydraulic elevator. If there is a permanently installed catwalk on your temperature control unit, use it. The work platform should have secure footing and a place for tools and parts. **DO NOT** climb on the temperature control unit, machines, or work from ladders.

If you need to repair a large component, use appropriate handling equipment. Before you use handling equipment (portable "A" frames, electric boom trucks, fork trucks, overhead cranes) be sure the load does not exceed the capacity of the handling equipment or cause it to become unstable.

Carefully test the condition of lifting cables, chains, ropes, slings, and hooks before using them to lift a load.

Be sure that all non-current carrying parts are correctly connected to earth ground with an electrical conductor that complies with current codes. Install in accordance with national and local codes.

When you have completed the repair or maintenance procedure, check your work and remove your tools, rigging, and handling equipment.
Do not restore power to the temperature control unit until all persons are clear of the area. **DO NOT** start and run the temperature control unit until you are sure all parts are functioning correctly.

BEFORE you turn the temperature control unit over to the operator for production, verify all enclosure panels, guards and safety devices are in place and functioning properly.

Reporting a Safety Defect

If you believe that your equipment has a defect that could cause injury, you should immediately discontinue its use and inform the manufacturer.
The principle factors that can result in injury are failure to follow proper operating procedures (i.e. lockout/tagout), or failure to maintain a clean and safe working environment.

-Notes-

Chapter:2 Functional Description

2-1 Introduction

The Compact and Upright Series water temperature control units are reliable, accurate, and easy-to-use process temperature control units. They are self-contained, portable, and shipped ready to use.

The Compact and Upright Series water temperature control units are designed to circulate water through your process and to precisely, automatically, and reliably maintain it at a specified temperature. Standard unit operating range is from 0ºF (-17ºC) to 250°F (121°C), or up to 300°F (149°C) as an option. The unit is suited for use with city water, water from portable or central chillers or towers, or well water.

These units are designed for rapid recirculation of a relatively small amount of water to provide close and uniform temperature relation between delivery and return lines. This performance, of course, depends on the configuration of your process and any restrictions within the mold. The recirculation, combined with the large immersion heater and cooling capability, gives fast and accurate response to bring the water up to temperature or to changes in the settings when needed.

The water temperature control unit is a self-contained system consisting of a centrifugal pump, electric immersion heater, cool/vent solenoid valve, and electrical control, including a PID microprocessor controller and thermocouple. It is designed for use in process temperature control applications using water or a water/glycol mix. Any other use or fluid **is prohibited**.

Some standard safety devices include a mechanical overtemperature safety thermostat, a pressure relief valve, motor overload protection, a low pressure cutout switch, branch fusing, and non-fused lockable rotary disconnect.

A properly installed, operated, and maintained water temperature control system provides years of reliable operation. Please read and follow the instructions in this manual to get the most satisfaction from your temperature control system.

2-2 Necessary Documents

The following documents are necessary for the operation, installation, and maintenance of a Compact and Upright water temperature control units. Additional copies are available from ACS Group.

Familiarize the appropriate personnel with these documents:

- ☑ This manual.
- ☑ The controller operation manual.
- ☑ The electrical schematic and connection diagram placed inside the control enclosure.
- ☑ The operation and installation manuals for accessories and options selected by the customer.
- ☑ The Customer Parts List included in the information packet.

2-3 Models Covered

This manual provides operation, installation, and maintenance instructions for the TrueTemp™ Series TCU, CWT Series TCU, and Royal Series 2010/2012 TCU water temperature control units.

Model numbers are listed on the serial tag. A model number followed by **Q** indicates a specially constructed unit, and not all information in this manual may apply. Make sure that you know the model number, serial number, and operating voltage of your temperature control unit if you contact the ACS Group.

2-4 Standard TCU Series Features

- Compact, rugged cabinet with easy-access side panels
- Cast-and-flange design to reduce connection points
- Half- and full-heat capability
- Over Current Protection for motor and transformer
- Dual stage Incoloy™ immersion heater with IEC contactors
- NEMA 12 electrical enclosure

- Forward-facing liquid-filled To and From Process pressure gauges
- Independent high temperature safety thermostat
- Non-fused lockable rotary disconnect
- Off-the-shelf microprocessor-based PID temperature controller with Process and Set Point LED readouts
- ¼" cooling solenoid valve on ¾ to 3 hp (0.56 to 2.24 kW) models; ½" slow-close cooling solenoid valve on 5 & 7½ hp (3.73 & 5.60 kW) models
- Graphic control panel with indicator and warning status lights
- Adjustable low supply water pressure switch; factory-set at 16 psig (110 kPa/1.1 bars)
- 150 psig (1,034 kPa/10.3 bars) pressure relief valve
- Choice of 208-575 operating voltages
- ¾" water supply and drain connections; 1½" process connections
- Automatic vent sequence
- 2" (51 mm) casters
- Operating range of 0ºF to 250ºF (-17ºC to 121ºC)
- PID Auto-tunning temperature controller

2-5 Available Options

Temperature control unit systems are available with options to tailor the unit to your requirements. Some are factory installed; some can be retro-fitted in the field. Consult ACS Group sales for more information. Available TCU options include:

- Digital flow meter with:
  - Up to 30 gpm (114 lpm) flow indicator

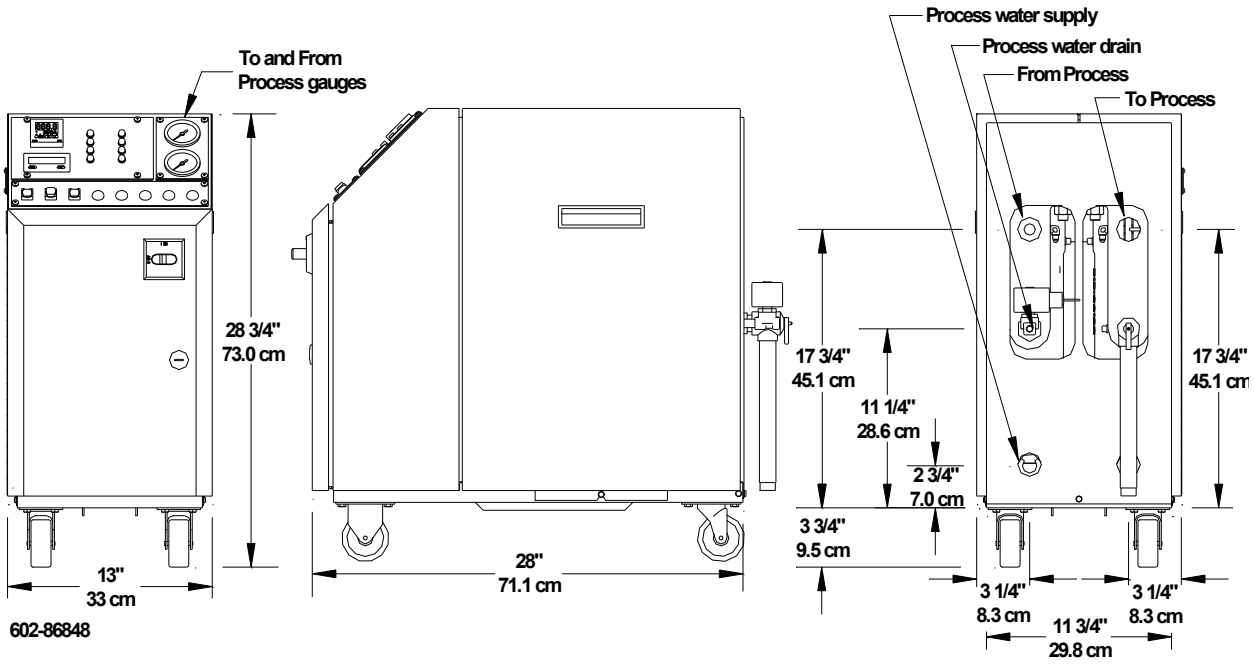
    - or -
  - 30 to 60 gpm (114 to 227 lpm) flow indicator

- or -

- Greater than 60 gpm (> 227 lpm) flow indicator

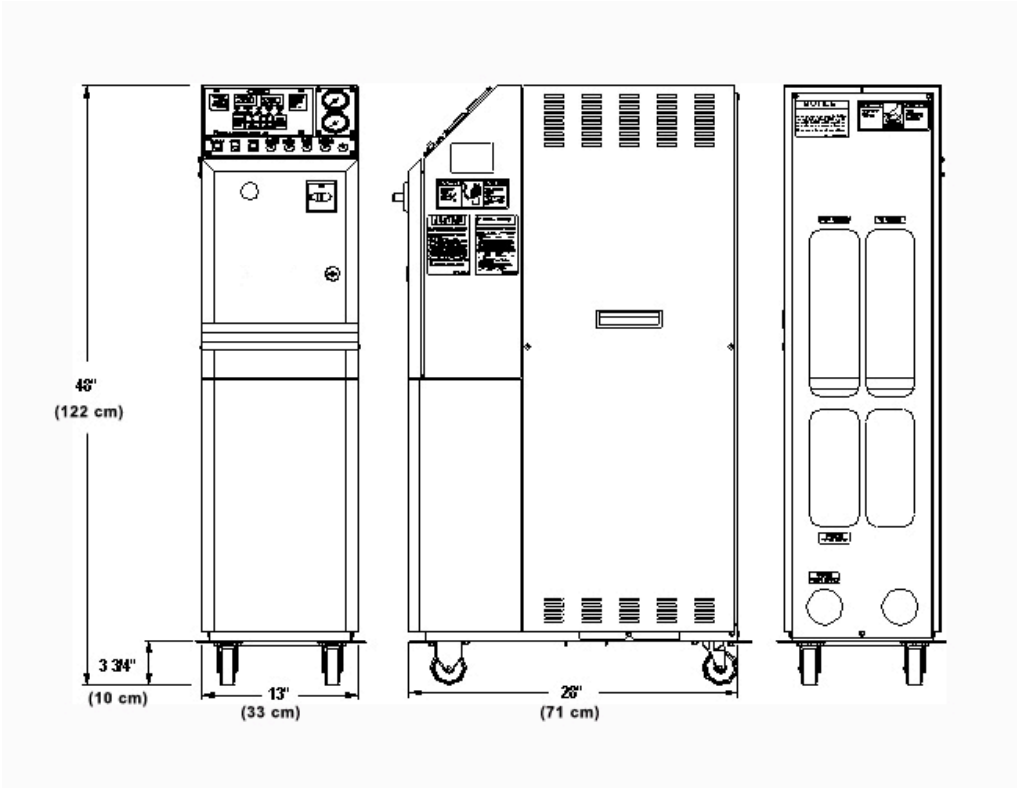
- 1/16, 1/8, 1/4 DIN PID Temperature controller with:
  - 4-20 mA current control output
  - Retransmission and remote set point; 4-20 mA, 2-10 V
  - RS-232 or RS-485 communications (Modbus, SPI, Ethernet)
  - Remote sensor; 10 ft. (3 m)
- Remote controller enclosure
- Heaters available in 12 kW, 18 kW, and 24 kW; 18 kW and 24 kW heaters available on 5 hp and 7½ hp (3.73 kW, 5.60 kW) direct-injection models only
- Closed-loop heat exchangers available in 3.7 sq. ft. and 7.4 sq. ft. (0.135 sq. m and 0.271 sq. m)
- Quick Cool function
- Auto system water purge (mold purge)
- Y-strainer
- Hammer arrestor (water hammer shock stop)
- Remote start/stop control
- Rubber feet; available in lieu of casters
- Non-ferrous brass construction
- Slow-close cooling solenoid valves available in ½" x 9⁄16" (C_V = 3.5) and ¾" x ¾" (C_V = 5.5)
- Modulating valves available in ½" (C_V = 0.4, 1.3, 2.2, or 4.4), ¾" (C_V = 5.5 or 7.5), 1" (C_V = 11), and 1¼" (C_V = 16)
- Two-zone stack rack with casters; common wiring and piping available
- 300ºF (149ºC) operation; includes silicon carbide seal
- Audible and visual general fault alarm
- Electrical operation available in 208, 460, and 575 volts, 60 Hz; 200, 380, and 415 volts, 50 Hz
- UL/$_C$UL-listed electrical subpanel, CE Compliance per EMC Low Voltage Directive

Figure 1
Typical Compact Water Temperature Control Unit and Specifications



Model number	Pump						Dimensions						Shipping weight	
							H		W		D			
	hp	kW	gpm	lpm	psig	kPa	in.	cm	in.	cm	in.	cm	lbs.	Kg
075	¾	0.56	30	113.6	25	172.4	28¾”	73.0	13”	33	28”	71.1	210	96
100	1	0.75	35	132.5	30	206.9	28¾”	73.0	13”	33	28”	71.1	210	96
200	2	1.50	50	189.3	30	206.9	28¾”	73.0	13”	33	28”	71.1	210	96
300	3	2.24	60	227.1	35	241.3	28¾”	73.0	13”	33	28”	71.1	210	96
500	5	3.73	90	340.7	50	344.8	28¾”	73.0	13”	33	28”	71.1	240	109
750	7½	5.60	120	454.2	50	344.8	28¾”	73.0	13”	33	28”	71.1	240	109

Figure 2
Typical Upright Series Water Temperature Control Unit
and Specifications



Model number	Pump						Dimensions H		W		D		Shipping weight	
460 / 230	**hp**	***kW***	**gpm**	***lpm***	**psig**	***kPa***	**in.**	***cm***	**in.**	***cm***	**in.**	***cm***	**lbs.**	***Kg***
075U	¾	*0.56*	30	*113.6*	25	*172.4*	**49⅞"**	***127***	13"	*33*	28"	*71.1*	240	*109*
100U	1	*0.75*	35	*132.5*	30	*206.9*								
200U	2	*1.50*	50	*189.3*	30	*206.9*								
300U	3	*2.24*	60	*227.1*	35	*241.3*								
500U	5	*3.73*	75	*283.9*	50	*344.8*							**270**	*123*
750U	7½	*5.60*	90	*340.7*	50	*344.8*								
1000U	10	*7.46*	120	*454.2*	55	*379.2*								

Additional Specifications

Model		Full-load amps at 460 volts ①				Pressure drop flow and loss			
hp	**kW**	**9 kW htr**	**12 kW htr**	**18 kW htr**	**24 kW htr**	**flow gpm**	***flow lpm***	**loss psi**	***loss kPa***
0.75 hp	*0.56 kW*	12.7 amps	16.5 amps	24.0 amps	31.6 amps	30.0 gpm	*113.6 lpm*	0.0 psi	*0.0 kPa*
1.00 hp	*0.75 kW*	13.1 amps	16.9 amps	24.4 amps	32.0 amps	35.0 gpm	*132.5 lpm*	1.0 psi	*6.9 kPa*
2.00 hp	*1.50 kW*	14.7 amps	18.5 amps	26.0 amps	33.6 amps	50.0 gpm	*189.3 lpm*	1.5 psi	*10.3 kPa*
3.00 hp	*2.24 kW*	16.1 amps	19.9 amps	27.4 amps	35.0 amps	60.0 gpm	*227.1 lpm*	2.0 psi	*13.8 kPa*
5.00 hp	*3.73 kW*	18.9 amps	22.7 amps	30.2 amps	37.8 amps	75.0 gpm	*283.9 lpm*	2.5 psi	*17.2 kPa*
7.50 hp	*5.60 kW*	22.3 amps	26.1 amps	33.6 amps	41.2 amps	90.0 gpm	*340.7 lpm*	5.0 psi	*34.4 kPa*
10.00 hp	*7.46 kW*	25.0 amps	28.5 amps	36.0 amps	43.0 amps	120.0 gpm	*454.2 lpm*	5.0 psi	*34.4 kPa*

① To calculate full load amps at 230 volts, multiply by **2.0**.

Chapter:3 Installation

3-1 Installation Location Considerations

The Compact and Upright Temperature control systems are portable and can be installed almost anywhere. As with all equipment installations, follow all applicable codes and regulations.

- ☑ The recommended ambient temperature range from +14ºF (-10ºC) to a maximum operating ambient temperature of 131°F (55ºC). Recommended ambient storage temperature range is from -13ºF to 149ºF (-25ºC to 65ºC). If storing the unit below freezing temperatures, make sure the unit has an antifreeze mixture circulated inside.
- ☑ Provide a minimum of twelve inches (12" or about 30 cm) clearance on all side of the cabinet to allow circulation of cooling air.
- ☑ Locate the unit as close to the process as is practical.

3-2 Process Approach Temperature Considerations

If the differential (△) between **COOLING WATER IN** and **TO PROCESS** temperatures is less than 10°F (7ºC), consult our Sales Department for advice on how to control low approach applications.

3-3 External Piping Sizing Considerations

- ☑ All external hose and piping should be adequately sized to assure minimum external pressure drop.
- ☑ Low external piping pressure drop is needed for best operation.

NOTICE Use a backup wrench to support the Compact or Upright temperature control system piping when making process piping connections.

⚠CAUTION

All external valves, fittings, and hoses must be rated at a minimum of 150 psig and 250ºF (1,034.25 kPa/10.34 bars and 121ºC).

The exception is when the temperature control unit is optionally rated for 300ºF (149ºC) operation; external valves fittings and hoses must then be rated at a minimum of 150 psig and 300ºF (1,034.25 kPa/10.34 bars and 121ºC).

3-4 Piping Considerations for Permanent Installations

ACS recommends an optional (or customer-installed) strainer on the **COOLING WATER IN** inlet.

The unit must have at least 16 psig (110.32 kPa/1.1 bars) water supply pressure to prevent pump cavitation that can be caused by the water "flashing" to steam. To avoid damage to the pump or other components, make sure that maximum supply pressure does not exceed 55 psig (379.2 kPa/3.79 bars).

Keep restrictions to a minimum by using proper inlet pipe sizing. If the water supply piping is larger than ¾", reduce the size at the unit. The table below contains the pipe sizes that are used in the unit.

Pipe sizes for ¾ hp to 10 hp (0.56 kW to 7.46 kW) units	
Location	**Size in inches NPT**
Process delivery	1½"
Process return	1½"
Water supply	¾"
Drain	*- depends on solenoid used -*

Common black pipe is recommended for permanent installations. The temperature control unit water circuit piping is primarily ferrous (iron) and reacts electro-chemically with non-ferrous metallic materials such as copper. Some water contains dissolved minerals that greatly accelerates the reaction between dissimilar metals. Ferrous piping is recommended to minimize galvanic action. If piping must be copper, use dielectric unions at the unit.

3-5 Piping Considerations for High Mobility Installations

Mobile temperature control systems must use high quality hose rated for **at least** 150 psig and 250°F (1,034.25 kPa/10.34 bars and 121ºC). Special 300°F (149ºC) high temperature control systems must use hosing rated at 150 psig and 300°F (1,034.25 kPa/10.34 bars and 149ºC) or greater.

Quick disconnects may be used for mobility, although **they cause a drop in pressure**. If used, they must be sized carefully to minimize pressure drop. Don't use quick disconnects with check valves *unless absolutely necessary*.

⚠CAUTION

Non-relieving quick connect fittings or check valves on the water supply must have a pressure relief piped to the drain.

Failure to do so could result in a dangerous over-pressure condition!

3-6 Process Water Considerations

Raw Water

Water treatment is vital in any piping system. In some cases, raw water may be used in the system without problems; in other cases, it can result in large deposits of scale and corrosion.

ACS offers a complete line of water treatment equipment. Contact your ACS sales representative for water testing and treatment options.

Distilled Water

Non-ferrous (brass, copper or high-temperature plastic) piping is recommended for distilled water processes.

Deionized Water

Stainless steel (316 SS minimum) or PVC plastic components must be used with deionized water. Stainless steel is recommened because of the temperature constraints with plastic.

3-7 Making Process Water Connections

Closed Circuit/Direct Injection

For both types of systems, the connections are basically the same. On the back of each unit, the connections are labeled appropriately. Connect the **DELIVERY** hookup to the entrance of the process and the **RETURN** hookup to the exit of the process. Connect the **WATER SUPPLY** to your plant water supply. Connect the **DRAIN** line to an open drain, or to the return line of your central water system.

Make sure you carefully select the connecting lines and connectors between the temperature control unit and the process to suit the needs and requirements of your application.

If your unit has a maximum operating temperature of 250ºF (121ºC), the connecting lines and connectors should have a service rating of at least 250ºF (121ºC) and 150 psig (1,034.25 kPa/10.34 bars). If it has a maximum temperature of 300ºF (149ºC), the lines and connectors should have a service rating of at least 300ºF (149ºC) and 150 psig (1,034.25 kPa/10.34 bars).

TO PROCESS — 1½" NPT

This is the outlet for the tempered water leading to the process being controlled.

FROM PROCESS — 1½" NPT

Water from the process re-enters the water temperature control system to be tempered and re-circulated back into the process.

3-8 Making Cooling Water Connections

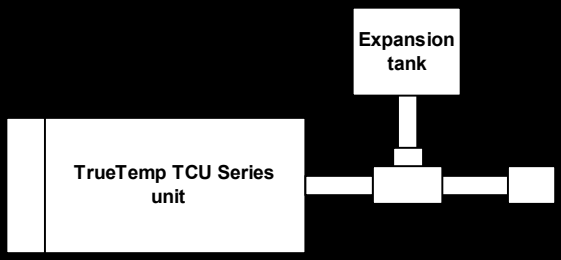
Water In — ¾"

The cooling water supply inlet from a cooling tower, a chiller, or a city water supply.

⚠CAUTION

If a non-relieving device such as a regulator, ball valve, or check valve is installed on the WATER IN line, you *MUST* install an expansion tank of at least ½ gallon (about 2 liters) capacity.

Failure to do so can result in system overpressure from thermal expansion. Install the tank configured as shown below:



Check the expansion tank frequently to make sure it is not flooded.

Water Out

Size Depends on Solenoid Used

The cooling water return outlet leading back to the cooling tower, chiller, or drain.

Net supply pressure must be between 25 psig and 55 psig (172.38 kPa/1.72 bars and 379.21 kPa/ 3.79 bars). Net supply below 15 psig (103.43 kPa/1.03 bars) may allow water to flash to steam, cavitate the impeller, and **damage the pump**, which prevents the unit from cooling properly. Operation above 55 psig (379.21 kPa/3.79 bars) may cause premature opening of the relief valve from pump pressure and pressure surges.

Pressure Relief — ¾"

The pressure relief valve must be piped to an open and unrestricted drain. Terminate in a manner to prevent scalding of nearby personnel in the event that the relief valve trips.

3-9 Making System Purge Connections

Compact and Upright temperature control systems equipped with the System Purge option have a compressed air inlet marked **MOLD PURGE**. Connect to a clean, dry 100 psig (689.50 kPa/6.90 bars) air line. Install your own shutoff valve to prevent process liquid from backing up into the plant air piping if the compressed air is turned off and the check valve fails. **Don't depend on the solenoid valve to hold water pressure in the temperature control unit.**

Figure 3
Typical Piping Schematic

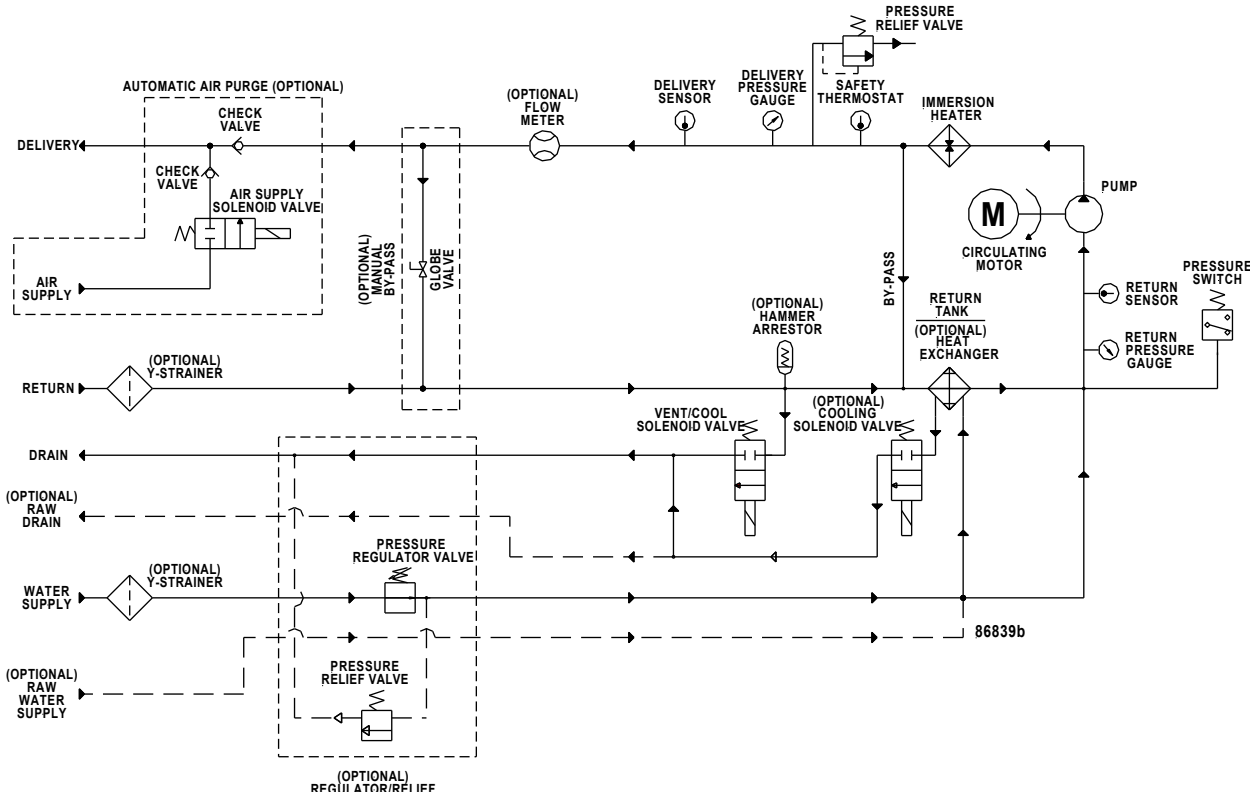
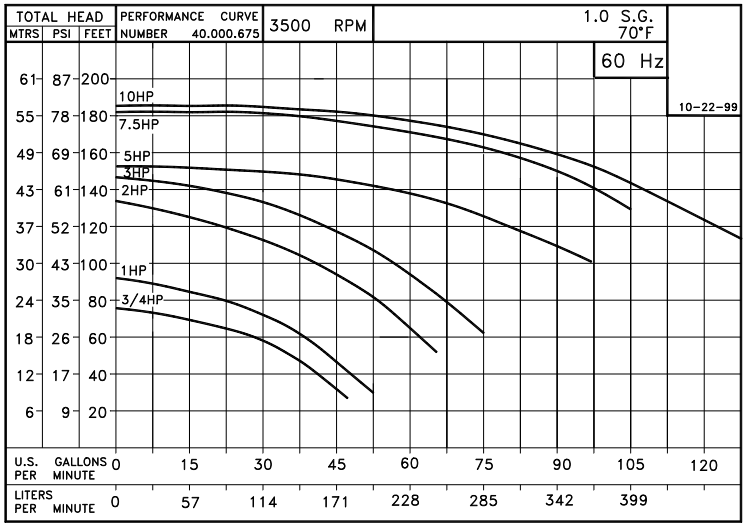


Figure 4
Pump Curves; 60 Hz



Pump Curves; 50 Hz • Consult Factory for 10 hp Curves

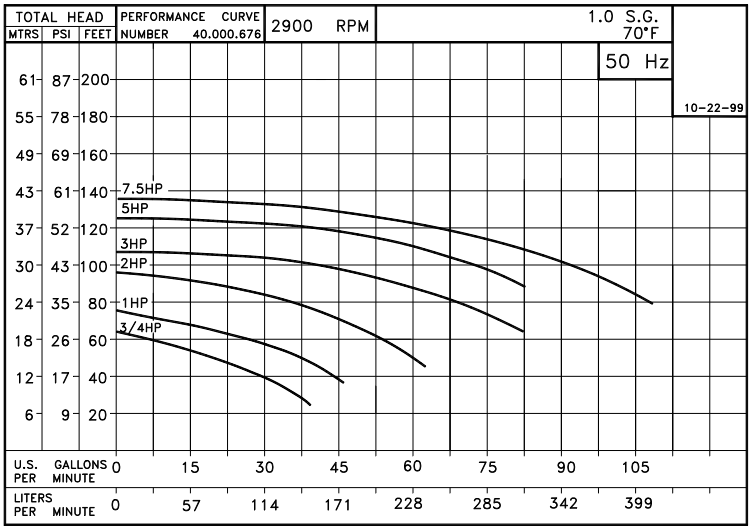


Figure 5
Pressure Drops

Model		Pressure drop flow and loss				
hp	**kW**	**9 kW htr**	**flow gpm**	***flow lpm***	**loss psi**	***loss kPa***
0.75 hp	*0.56 kW*	12.7 amps	30.0 gpm	*113.6 lpm*	0.0 psi	*0.0 kPa*
1.00 hp	*0.75 kW*	13.1 amps	35.0 gpm	*132.5 lpm*	1.0 psi	*6.9 kPa*
2.00 hp	*1.50 kW*	14.7 amps	50.0 gpm	*189.3 lpm*	1.5 psi	*10.3 kPa*
3.00 hp	*2.24 kW*	16.1 amps	60.0 gpm	*227.1 lpm*	2.0 psi	*13.8 kPa*
5.00 hp	*3.73 kW*	18.9 amps	75.0 gpm	*283.9 lpm*	2.5 psi	*17.2 kPa*
7.50 hp	*5.60 kW*	22.3 amps	90.0 gpm	*340.7 lpm*	5.0 psi	*34.4 kPa*
10.00 hp	*7.46 kW*	26.0 amps	120.0 gpm	*454.2 lpm*	5.0 psi	*34.4 kPa*

3-10 Making Electrical Connections

Compact and Upright temperature control systems are designed for three-phase voltage operation. Refer to the unit nameplate for proper voltage and amperage requirements.

Make sure you provide a correctly sized and protected supply of electrical power to the unit.

⚠CAUTION

Refer to National Electric Code (NEC) Article 430-24 through 430-26 for proper feeder conductor and supply disconnect sizing.

Maintain a safe ground and disconnect the power supply before servicing the unit. A qualified electrician should make electrical connections, and disconnect and lock out electricity using OSHA 29CFR 1910.147 standards when you need a service call.

Check serial tag voltage and amperage requirements and make sure your electrical service conforms *before* making any electrical connections. Total running amps for Compact and Upright temperature control systems are listed on the nameplate. Customer connections can be run to the supply terminals from either side of the unit. Make sure that all three phases are wired correctly. If not wired properly, the unit will run *backwards*. **Again, check the unit nameplate for correct voltage and amperage.**

⚠DANGER

Improper electrical connections can damage the unit and cause serious operator injury or death!

Bring properly sized power leads and ground from a fused disconnect (installed by your electrician) to the unit. Provide external overcurrent protection to the unit, using circuit breakers or fuses. If you use fuses, make sure that they are dual-element time-delay fuses, sized according to your electrical code. Make sure that **all** electrical connections are ***tight***.

⚠CAUTION

1. **Electrical connections must comply with all applicable electrical codes.**
2. **The temperature control unit must be grounded in accordance with NEC Article 250.**
3. **Voltage must be within plus or minus ten percent (±10%) of the nameplate rating.**
4. **Make sure your installer provides external protection.**

Figure 6
Typical Electrical Wiring Schematic

Please refer to the electrical wiring diagrams supplied with your unit's Customer Information Packet.

Chapter:4 Identifying Controls and Features

4-1 Identifying Mechanical Controls and Features

To Process Thermocouple

A type K ungrounded thermocouple with a 304SS probe is downstream from the heater to sense process temperature.

Safety Thermostat

The safety thermostat mounted on the side of the heater tank protects against thermal runaway. The thermostat guards against the unlikely event of "runaway" heating. If overheating occurs, the safety thermostat shuts down heater outputs. The unit continues to pump water through the system to prevent heater damage. The ACS Group recommends that you install an audible or visual alarm to the terminals provided. Factory installed alarms are available; see the electrical schematics in the installation packet for more information.

Pressure Relief Valve

If the combined pressure of the cooling supply water and pump discharge exceeds 150 psig (1,034.25 kPa/10.34 bars), the pressure relief valve opens and relieves the pressure. This is a non-adjustable ASME construction valve with a stainless steel spring.

⚠CAUTION

Route a pipe from the pressure relief valve to a suitable drain to reduce potential scalding hazard.

The drain line must not have any restrictions or back pressure.

Low Pressure Cutout Switch

This switch (set at 16 psig, 2 psig differential [110.3 kPa/1.10 bars with a 13.79 kPa/0.14 bars differential]) shuts down the unit if the **COOLING WATER IN** or **MAKEUP** water pressure drops below 16 psig (110.3 kPa/1.10 bars).

Pumps

Pumps range in power from ¾ hp to 7½ hp (0.56 kW to 5.59 kW) and are equipped with 3-phase ODP motors and seal flush lines as standard.

The pump is a bronze-fitted straight centrifugal type. It features a split case design to facilitate replacement of the seal. It has a high output capacity with excellent discharge pressure helping it facilitate turbulence to maximize heat transfer, and is well suited for the conditions under which it was designed to operate.

Heaters

The specially designed 9 kW three-phase low watt density electrical immersion heater heats the water, and the controller regulates the temperature. The standard heater has an incolloy sheath for best heat transfer.

Low watt density immersion heaters at 12 kW, 18 kW (dual 9 kW heaters), or 24 kW (dual 12 kW heaters) are available options for these models, depending upon the heating needs of the process. All models are built to provide full or partial heat as required by the process and determined by the controller, providing more precise temperature control.

Solenoid Valves

Compact and Upright temperature control systems use rugged, industrial design solenoids with replaceable coils and/or internal components. Depending on required cooling capacity, solenoid valves are available in sizes ranging from ¼" to ¾"; ½" x 9⁄16" and ¾" x ¾" solenoid valves are slow-closing.

4-2 Motorized Modulating Valves

Optional

Optional motorized modulating valves are recommended for large cooling applications where the process temperature is very near the cooling water supply temperature. The gradual shutoff they provide also eliminates water hammer. The option includes a complete valve and motor package in place of a long-life solenoid valve.

The motorized modulating valve has infinite positioning.

4-3 Water Hammer Arrestor (Shock Stop)

Optional

Shock waves from fast-operating solenoid valves may damage some process systems. For these applications, a welded metal bellows-type shock stop with a pre-charged and sealed nitrogen blanket can be installed in the cooling piping.

Pump Starter

Compact and Upright temperature controllers high quality IEC-rated pump motor starters are industrial grade motor controls with overload and overcurrent protection with manual reset.

Transformer

High quality industrial design transformers are specified to suit incoming voltage on the application and provide 115 VAC control voltage. The transformer is protected by primary fusing with secondary grounding.

Heater Contactor

Your TCU unit uses high-quality IEC-rated industrial-grade electromechanical contactors for heater controls.

Cooling

The controller automatically regulates cooling by opening and closing the solenoid valve or modulating valve. For direct injection, the unit cools by removing the required amount of warm water from the system. This process permits an equal amount of cool plant water to enter the system well ahead of the pump, allowing it to blend with the system water. The water supply temperature governs the minimum operating temperature of the unit.

For closed circuit operation, the unit cools by automatically releasing cooling water through the tubes of the specially designed shell and tube heat exchanger in each zone. The process fluid, such as water, glycol, or other similar fluid, is circulated through the shell of the heat exchanger.

NOTICE

The plant water supply temperature governs the minimum operating temperature of the unit.

Electricals

The pump motor and the immersion heater operate on three-phase 50/60 cycle nominal voltages with the control circuit operating at 115V single phase. The control circuit voltage is provided by a single phase machine tool transformer with a grounded secondary.

The 115V control circuit is fuse protected. The pump motor is controlled by a full voltage magnetic non-reversing motor starter, with overcurrent and thermal overload protection.

Automatic Vent

This feature automatically triggers a quick and complete purge of air from the system before you start the unit. The vent actuates the solenoid valve, and forces trapped air and water out through the drain, properly filling and priming the unit prior to startup. ***Complete venting is necessary to prevent damage to the pump and heater.***

Pressure Switch

A pressure switch built into each unit keeps the system from starting until the water supply is turned **On** and subjected to the minimum water supply pressure. This feature protects the pump seal and the heater from damage through attempted operation without water. The pressure switch is set at approximately 16 psig (110.32 kPa/1.10 bars) for 250°F (121ºC) units or 55 psig (379.23 kPa/3.79 bars) for 300°F (149ºC) units prior to leaving the factory.

4-4 The Microprocessor Controller

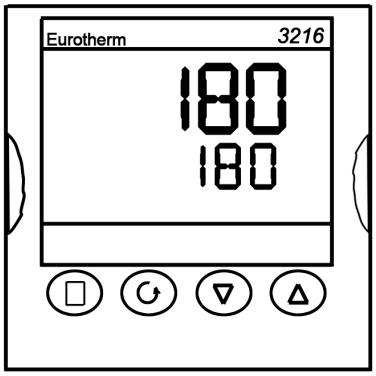
The controller is an easy-to-operate microprocessor-based PID control device. When the process reaches the set point, the PID control cycles the cooling valve and/or immersion heater to maintain the proper leaving water temperature.

The controller has been fully factory tested, and loaded with preset tuning parameters. To quickly adapt the controller to your process, you may elect to tune the controller at start-up. Refer to the Auto-tune section, 5-3.

Built-in range of operation on the controller is 0°F to 250°F (-18ºC to 121ºC).

4-5 Controller Display

Figure 7
Typical 3216 Microprocessor Controller



See Figure 7

Measured Temperature Value Numeric LED

During normal operation, the large green **PV** Process Value LED on the controller displays the actual process temperature at the To Process thermocouple. It also lists parameter symbols during setup and error messages if an error occurs.

Required Temperature Numeric LED

During normal operation, the smaller green **SP** Set Value LED on the controller displays the process set point you want the chiller to maintain. It also displays parameter and pre-set function values during setup.

See Figure 7

Page Key

From any display – press to return to the HOME display.

Scroll Key

Press to select a new parameter. If held down it will continuously scroll through the parameters.

⚠CAUTION

Do not change any of the control settings without consulting the ACS Group Service Department.

***The ACS Group warranty does not cover temperature control unit failures from tampering with controller settings*!**

Down Key

Each press of the **Down Arrow** key decrements or reduces the values or settings on the **SV** Set Value display.

Up Key

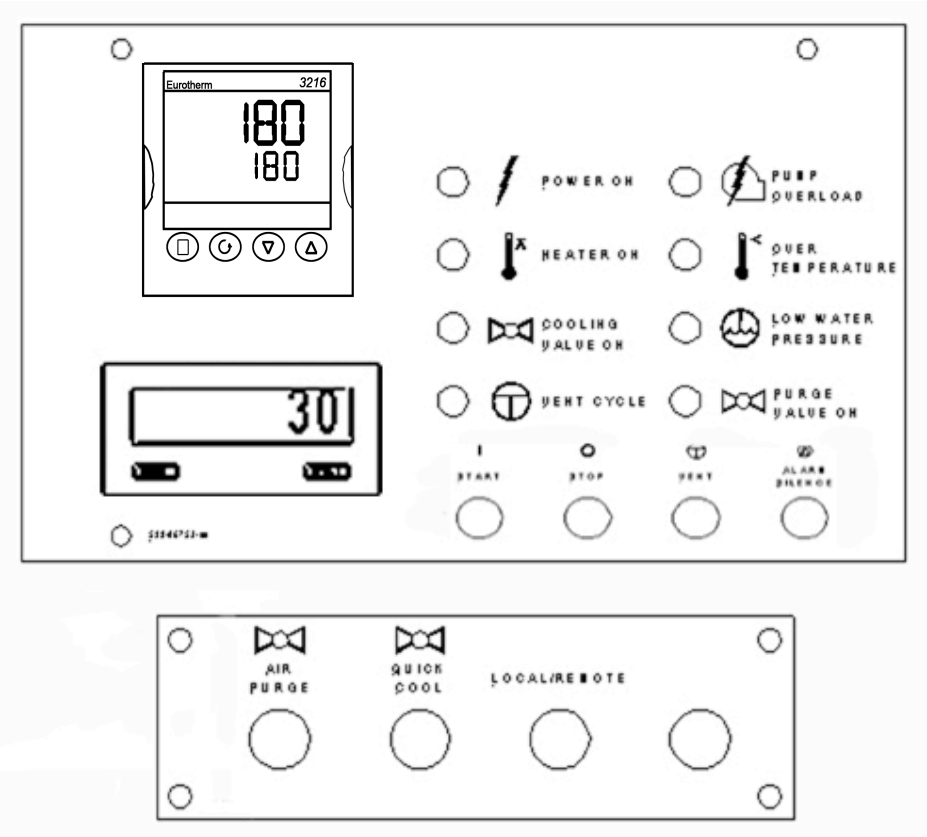
Each press of the **Up Arrow** key increments or advances the values or settings on the **SV** Set Value display.

4-6 Digital Flow Meter

Optional

The optional digital flow meter measures process flow in gallons per minute (gpm), or liters per min (lpm). Controls are set at the factory; no adjustment by customer is necessary. Depending on option level and setup, flows can be measured at rates reaching and exceeding 60 gallons per minute (227 lpm).

Figure 8
Typical Graphic and Button Panels; Optional Digital Flow Meter Shown



4-7 Identifying Graphic Panel Indicators

POWER ON Indicator

The green **POWER ON** indicator lights when the temperature control unit is energized.

PUMP OVERLOAD Indicator

The red **PUMP OVERLOAD** indicator lights if the pump motor overload opens from high amp draw. The pump motor contactor drops out, protecting the motor.

HEATER ON Indicator

The red **HEATER ON** indicator lights during heater operation. The **HEAT** LED on the controller lights at the same time.

OVER TEMPERATURE Indicator

The red **OVER TEMPERATURE** indicator lights if the process temperature rises above the safety thermostat setting.

COOLING VALVE ON Indicator

The green **COOLING VALVE ON** indicator lights during cooling valve operation. If the unit has a standard solenoid (not motorized) cooling valve, the **OUT 2** LED on the controller lights at the same time.

LOW WATER PRESSURE Indicator

The red **LOW WATER PRESSURE** indicator lights if cooling water pressure drops below 16 psig (110.32 kPa/11.03 bars). The pressure switch opens and shuts down the 115 VAC control power.

VENT CYCLE Indicator

The green **VENT CYCLE** indicator lights during vent cycle operation.

PURGE VALVE ON Indicator

Units with Optional System Purge

The amber **PURGE VALVE ON** indicator lights when the **AIR PURGE** switch is **ON**. This option purges water from the process. When control power is **OFF** and the **AIR PURGE** switch is pressed, the system purge solenoid and cool/vent valves open. Air displaces the water in the Water Temperature Control system and the process piping, pushing the water out the **WATER OUT** line.

A check valve in the Water Temperature Control system piping and a shutoff valve on the **Water In** line insure that the water has only one path to follow.

To activate system water purge:

1. Turn the unit off with the stop button on the graphic panel.
2. Close the **COOLING WATER IN** line shutoff valve.
3. Open the compressed air line shutoff valve.
4. Turn on the **AIR PURGE** switch.

When water no longer comes out of the cooling **WATER OUT** line and only air comes out, the purge is complete. ***Use caution*** **when removing these lines;** air pressure is still present inside.

4-8 Using Graphic Panel Buttons

Figure 8

START Button

Push the **START** button to energize the unit and begin the temperature control cycle.

STOP Button

Push the **STOP** button to de-energize the unit and stop the temperature control cycle.

VENT Button

Push the **VENT** button for additional manual venting. The **VENT CYCLE** indicator lights during the vent cycle.

ALARM SILENCE Button

Optional

Turn on **ALARM SILENCE** switch to silence the alarm. You should investigate the alarm condition and restore the unit to normal operation before continuing with the temperature control cycle.

AIR PURGE Button

Optional

Turn on the **AIR PURGE** switch to purge the system of air. The **PURGE VALVE ON** indicator lights during the air purge cycle.

QUICK COOL Button

Optional

Turn on the **QUICK COOL** switch to open the cooling valve and quickly cool the process.

LOCAL/REMOTE Button

Optional

Turn on the **LOCAL/REMOTE** switch to toggle between local and remote temperature sensor probe operation.

4-9 Alarms

Audible/Visual General Fault Alarm

Optional

The audible/visual general fault alarm sounds if any fault triggers, such as low water pressure, over-temperature, or pump overload. A signal from any of the safety devices activates a horn and flashing strobe.

- Push the **ALARM SILENCE** button to silence the alarm.

  The optional mechanical high temperature safety alarm is interlocked with the heater. When triggered, the heater cuts out and the pump continues to run.

4-10 Controller Internal Switches

The controller is set up and tested at the factory for optimum operation, and adjusting the internal switches is not necessary. If the controller does not work properly, or you suspect someone has accidentally changed some settings, there are two things to do. First, perform the Auto-Tune procedure described in Section 4-10. If that doesn't work, restore the controller to the orig-inal factory settings as described in Section 6-3.

4-11 Communications

A connection port on the electrical cabinet permits easy hook-up to the host computer for RS-485 communications. The connection port is a direct pin-to-pin extension from the back of the controller. For pin outs, consult the Communication Manual for the PID controller.

Chapter:5 Startup and Operation

5-1 Introduction

The checklist below outlines start-up procedures for Compact and Upright Series water temperature control units. This list assumes that installation information located in this manual has been read and followed.

5-2 Startup Checklist

- ☑ Check the shipping papers against the serial tag to make sure that system size, type, and voltage is correct for the process under control.
- ☑ Check the transformer primary voltage connections to be sure they are configured for the electrical power you are using. The voltage at the main power connection must be within plus or minus ten percent (±10%) of the voltage listed on the serial tag. Electrical connections must conform to all applicable codes. Make sure that a qualified electrician checks all electrical connections.
- ☑ The safety thermostat is preset at the factory to 250ºF or 300ºF (121ºC or 149ºC), depending on configuration. It trips at 265ºF or 315ºF (129ºC or 157ºC), depending on configuration.
- ☑ The relief valve should be piped to an open, unrestricted drain.
- ☑ **TO PROCESS**, **FROM PROCESS**, **WATER IN**, **WATER OUT**, and **MOLD PURGE** connections should be complete.

⚠CAUTION

Only use components rated at a minimum of 150 psig and 250ºF (1,034.25 kPa/10.34 bars and 121ºC).

- ☑ **All outer panels must be in place**.
- ☑ All external process valving should be set for proper operation of the unit.

- ☑ Cooling and/or makeup water between 16 psig and 55 psig (110.32 kPa/1.1 bars and 379.23 kPa/3.79 bars) must be available for the unit to operate properly.
- ☑ Connect the main power to the unit disconnect switch, and press the **START** switch to check for proper pump rotation direction as described in Section 5-6 on Page 44. Pump rotation should be clockwise, viewed from the **motor** end.
- ☑ Check your work and proceed to the **Startup Procedure** section on the following page.

5-3 Starting the Temperature Control Unit

You can also use these steps to AUTO-TUNE the Controller, and operate the Unit with the Controller.

The Auto-Tune function lets you fine-tune the control PID to process requirements. Activate the Auto-Tune function whenever the process under control changes. Don't be alarmed by control response. It may take the process temperature above and below the set points as many as three (3) times. It will then level off and control to the process set point. **Auto-tuning can take up to 45 minutes**, and is best done *before* any product is run.

1. Push the **ON/OFF** rocker switch to the **ON (|)** to energize the unit and begin the temperature control cycle. The switch will be illuminated whenever the unit is on.
2. The unit will automatically vent for approximately one minute.
3. If needed, press and hold the vent button to purge any additional air from the process loop.
4. Set process temperature (**PV**) by pressing the **Scroll** key until SP1 appears in the upper display. Then press the **Up Arrow** or **Down Arrow** keys to adjust the setpoint.
5. If the unit does not maintain its process value, allow your process to reach the set point temperature. Then Autotune the control by pressing the the Scroll key until SP1 appears in the upper display. Then press the Up Arrow or Down Arrow keys to activate the tune.

⚠CAUTION

1) Your Water Temperature Control system operates with hot water under pressure. To reduce the risk of scalding:

- **Always wear work gloves and safety glasses when operating the unit.**
- **Never operate the unit with panels or shields removed.**
- **Pipe the relief valve to an open drain.**
- **Never install a fitting or hose that is rated less than 150 psig and 250°F (1,034.25 kPa/10.34 bars and 121ºC).**

2) To reduce the risk of electrical shock:

- **All electrical installation and repairs should be done by a qualified electrician.**
- **Ground the unit in accordance with electrical codes.**
- **Never attempt any repairs without first opening and locking out the main disconnect.**
- **Never deactivate or neutralize any safety device.**

5-4 Sequence of Operation

The simplicity of design and the highly engineered controller make this unit almost self-operating. The **START**, **STOP**, and **VENT** buttons and the temperature controller buttons are all that is required to operate this unit.

After you complete all connections, turn the water supply **ON**, then turn control power **ON**. The unit automatically vents for a preset time of one (1) minute. If you need additional vent time, press the **VENT** button on the control panel.

As the water comes in the water supply line, the water must enter the pump, up through the tank and out through the delivery line, through the process, back through the return line, and through the solenoid line and out the drain line.

At this time, watching the drain for bubbles or erratic flow will indicate whether or not the system has been properly vented. If a steady stream flows from the drain line, it is certain that all the air is out of the system.

☑ TCU systems provide temperature control on processes by directly heating the process water and injecting cooling water into the process water.

- ☑ When the unit is energized, the pump starts and a one minute vent sequence opens the cooling/vent valve to remove any air trapped in the process piping.
- ☑ If the cooling water supply pressure is insufficient, the low cooling water pressure cutout switch (set at 16 psig, 10 psig differential [110.32 kPa/1.10 bars, 68.95 kPa/0.69 bars differential]) opens, the **LOW WATER PRESSURE** indicator lights, and the unit does not operate until the pressure is 16 psig (110.32 kPa/1.10 bars) or more. **You need at least 16 psig** (110.32 kPa/1.10 bars) for the best cooling capacity and to prevent water boiling in the process circuit at high temperatures, particularly at the pump suction.
- ☑ After venting, the microprocessor controller monitors the **TO PROCESS** sensor, cycling open the cooling/vent valve to discharge warm water or energizing the immersion heater to maintain the process set temperature.

5-5 Checking Motor Rotation Direction

Check for correct pump rotation direction by looking at the motor impeller. Press the **START** button and the **STOP** button, and note the direction that the motor turns. Rotation should be **clockwise** when viewed from the motor end.

Note: Make sure that a qualified electrician performs the following steps.

To change rotation direction:

1. Disconnect and lock out power at the fused disconnect.
2. Reverse any two incoming leads at the power terminal blocks.
3. Do not switch leads at the motor or motor starters.

5-6 Shutting Down the Temperature Control Unit

Cool the unit down by selecting a set point of zero (***0***). Let the unit stabilize at one temperature close to the incoming water temperature, then press the **STOP** button. Now press the **VENT** button to relieve any remaining pressure in the system.

- Notes -

Chapter:6 Unit Maintenance

⚠CAUTION

Never attempt to service a unit until a qualified electrician has opened and locked out the main disconnect using OSHA 1910.147 standards.

The water supply should be turned off and internal pressure should be relieved before you remove panels.

All electrical connections must be done by a qualified electrician.

⚠WARNING

Disconnect all power to the unit, let the unit cool down, and turn off the water *prior to any servicing*.

Failure to do so can result in SERIOUS INJURY OR DEATH!

6-1 Preventive Maintenance

Draining

Drain the TCU thoroughly if you are taking it out of service for a long period of time, or you expose it to freezing. Drain plugs are provided at the base of the heater tank and at the base of the pump pedestal.

Periodic Checks

Every Six Months

Inspect all electrical connections for secure attachment and for safe and secure ground connections. Inspect the power cable, especially at the entrance point to the unit. This inspection should be made by a qualified electrician. Check for leaks, especially under the pump, as it may indicate a worn pump seal.

6-2 Corrective Maintenance

Pumps and Seals

Before leaving our factory, we test each unit extensively, then we calibrate each unit. Afterwards, the unit is drained and blown out with air to remove water from piping systems. If the unit is allowed to stand idle for a long time before being installed in your factory, the housing gasket at the pump can dry out and can possibly leak when the unit is started. In most cases these gaskets will soon swell and form a tight seal. In other cases, it may be necessary for you to tighten the pump bolts to stop a leaking condition.

Pump seal surfaces can separate slightly because of rough handling or from vibration during transit. This could cause a leak at the pump seal when the pump is started, but in most cases the surfaces will mate again after the pump is allowed to run for a short period of time. If they do not reseal, you may need to open the pump and free the seal by hand. It is seldom necessary to install a replacement seal in a new unit unless the seal has been damaged because the unit was started without water.

Our pump seals have a long period of service life. Some conditions, of course, can shorten seal life, including the presence of grit, operation of the unit without water, sustained high water temperature, or presence of certain chemicals in the water. Our pump seal assembly has been developed to resist abrasive particles that are present in many water systems. This is done by a special flushing system that uses water exiting the pump to constantly wash the seal area.

It is also fitted with high temperature flexible components for maximum heat resistance. These same components remain flexible even at low temperatures. Thus, the standard seal is a fine combination of heat resistant and wear resistant components. Unfortunately, even under normal use, the seal will eventually wear and require replacement.

A small puddle underneath the unit is a sign of rotary seal wear, and if investigation confirms the pump as the source, the seal should be replaced as soon as practical. The water slinger is intended to provide temporary protection against this, but a continued and substantial leak will ruin the motor bearing and cause further damage.

After the unit has been in service for a period of years where abrasive conditions are present, you may find that the pump bracket (the top half of the pump casting), can be eroded away in the area around the seat of the rotary seal. This area should provide a straight, smooth bearing surface for the cup seal. Should your casting show signs of erosion in this area, the casting needs to be replaced. The replacement cost of the casting is very modest compared to the down time and maintenance cost for frequently replacing the seal.

Under some conditions, the pump may not start. After turning off the power supply, check the motor shaft to be certain it is free to turn. By removing the drip cover on top of the motor, you'll have access to the end of the shaft. It has been slotted to make it easy to turn with a screwdriver. If the shaft is free to turn, next check that the motor overloads are set, check for blown fuses, and finally check the power supply on each leg to the motor. A qualified electrician should check the motor and its circuit.

⚠CAUTION

If the pump motor wiring is disconnected for removal from the unit, make sure that you check the actual rotation direction when the motor is rewired to the unit.

A phase sensor does not always indicate proper rotation if motor wire leads are reversed at installation.

Consult the elementary wiring diagram for more information.

Heaters

Heaters may need to be cleaned chemically or mechanically to remove deposits and dirt that reduce heat transfer and cause hot spots. Hot spots cause premature heater failure. Install a new gasket when reassembling. Make sure a qualified electrician disconnects and reconnects heater wires.

Solenoid Valves

- ☑ Clean annually, more often if using high mineral content water or on high service level units.
- ☑ Sluggish operation, excessive leakage, and/or noise indicate cleaning is necessary. Inspect the components for excessive wear while the valve is disassembled.
- ☑ Rebuild kits are available from the ACS Group Parts Department.

6-4 Electrical Connections

Make sure that a qualified electrician inspects all electrical components and connections every six (6) months for secure attachment and ground connections. Inspect all wiring for fraying or damage, especially power lines where they enter the unit. **All wiring connections must be *tight*.**

6-5 Safety Devices

⚠CAUTION

Make sure that only qualified electricians test safety devices!

Safety devices should be tested for function **every six (6) months**. Perform the following procedures for testing:

Motor Overload

Disconnect main power. Open the electrical enclosure and rotate the manual **TEST** button on the motor overload to the tripped position. Close the enclosure and reconnect main power. Push the **START** button. The unit should **not** start and the **Pump Overload** indicator should illuminate.

Press the **RESET** button. The unit is now ready for operation.

Pressure Switch

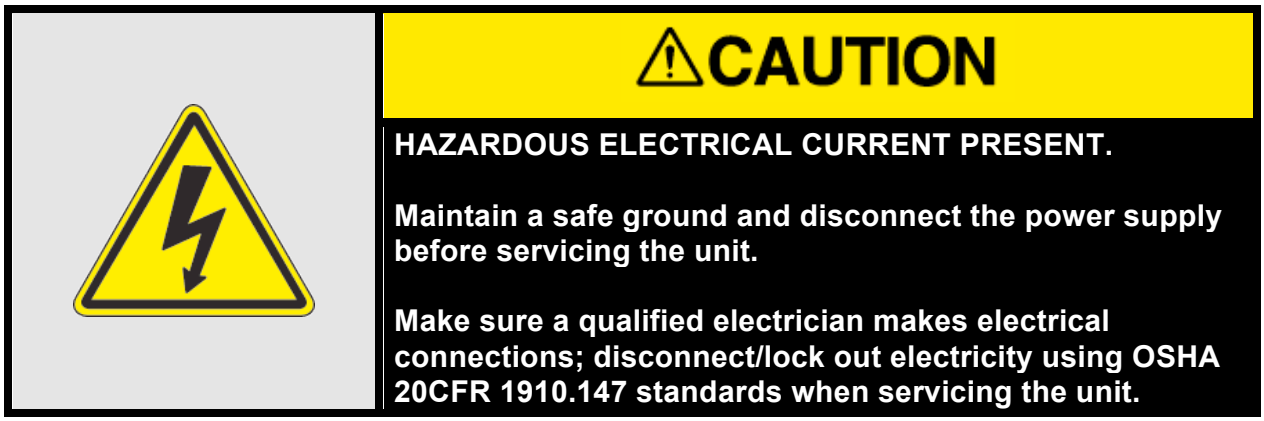
With the unit running, program a set point of 30ºF (-1ºC). Allow the process temperature to drop under 100ºF (38ºC). When the process temperature reaches that point, turn off the water supply. The pump should stop and the Low Water Pressure indicator should illuminate. Turn the water supply on to reset the pressure switch.

Adjusting the Pressure Switch

The pressure switch used in your Water Temperature Control Unit is factory set at 16 psig (110.3 kPa/1.1 bars). However, if the process does not require the unit to operate at 250ºF (121ºC), you can adjust the switch to meet your process needs.

Tools Required

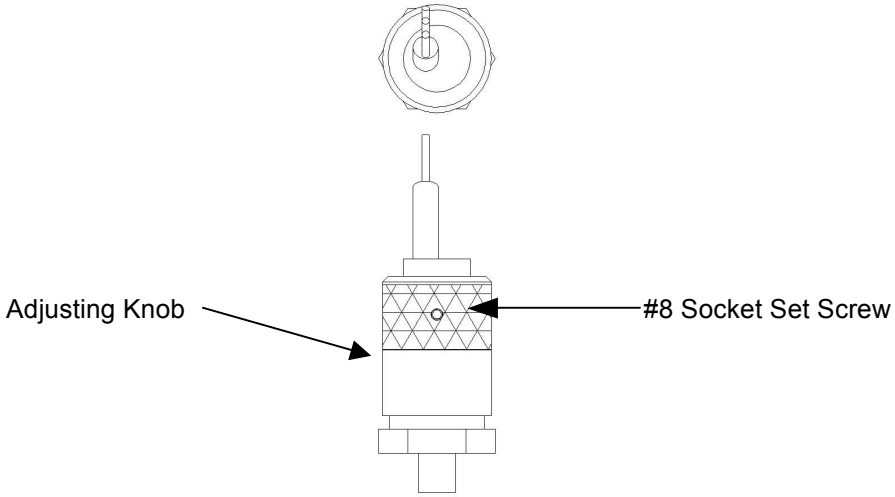
- 5/64 (#8) Hex Key


⚠CAUTION
HAZARDOUS ELECTRICAL CURRENT PRESENT.
Maintain a safe ground and disconnect the power supply before servicing the unit.
Make sure a qualified electrician makes electrical connections; disconnect/lock out electricity using OSHA 20CFR 1910.147 standards when servicing the unit.

To adjust the pressure switch:

Figure 9

Pressure Switch
Side View and Top View



- Turn the set screw **counter-clockwise** to loosen, unlocking the adjusting knob.
- To adjust pressure switch turn adjusting knob **clockwise** to increase the pressure.

- or -

- Turn adjusting knob **counter-clockwise** to decrease the pressure.

A quarter turn (90° rotation) approximates 10 psi (68.9 kPa/0.7 bars).

- Turn the set screw **clockwise** to tighten, locking the adjusting knob.

Make sure that the high limit on the controller is set to the values listed in the following table, based on the switch adjustment. This prevents the pump from cavitating and damaging the seal, the switch, and heater element(s).

psig	kPa	Max. temp. ºF	Max. temp. ºC
5 psig	34.4 kPa	227ºF	108ºC
10 psig	68.9 kPa	240ºF	116ºC
15 psig	103.4 kPa	250ºF	121ºC

Safety Thermostat

Disconnect main power. Open the electrical enclosure and disconnect the neutral lead on the safety thermostat from the terminal strip. Protect the stripped lead to prevent short circuits. Close the enclosure, reconnect main power, and push the **START**

button. The heater should **not** turn on and the **Over Temperature** indicator should illuminate. **Disconnect main power before reconnecting the thermostat lead**.

6-6 Cleaning and Storage

- **Inspect the unit daily for leaks**. Wipe down the unit periodically to remove dirt and dust buildup, especially the motor casing.
- Drain and flush the unit every six (6) months to remove sediment buildup.
- Completely drain the unit and **carefully** blow out the piping with pressurized air before placing the unit in storage.

Chapter:7 Troubleshooting

Condition	Possible cause	Solution
Unit does not turn on.	No power.	Check main disconnect, fuses, wiring, and power lead to unit.
	Wrong voltage supplied to unit.	Voltage must be within plus or minus 10% of nameplate rating.
	Defective on/off switch.	Replace.
	Control circuit fuse blown.	Replace.
	Defective control transformer.	Check transformer.
Unit does not run.	Broken or loose wire in pump motor control circuit.	Locate and repair.
	Pump motor contactor holding coil is open.	Repair or replace.
	Low water pressure light on.	Check for at least 16 psig (110.32 kPa/1.1 bars) water pressure on **WATER IN** or **CITY WATER MAKEUP**.
	Water supply to unit is turned off.	Open water supply.
	Pump overload light on.	Reset and test each leg for balanced amp draws.
Low pump pressure.	Pump running in reverse.	Verify proper rotation. If not clockwise, reverse any two incoming power leads.
	Foreign matter in the system.	Clean the system.
	System has minimal back pressure, and is operating at the far end of the pump curve.	As long as there is satisfactory process temperature control there is no problem.
High pump pressure.	Foreign matter obstructing system.	Clean the system.
	Restricted water flow.	Check for closed valves etc. Be sure all lines are properly sized.
	System has high back pressure, and is operating at the near end of the pump curve; a low flow condition.	As long as there is satisfactory process temperature control there is no problem.

Condition	Possible cause	Solution
Pressure switch circuit is open.	Insufficient cooling or makeup water pressure.	Check for 25 psig (172.38 kPa/1.72 bars) water pressure on **WATER IN** or **CITY WATER MAKEUP**.
	Switch is broken.	Jump power across switch and see if unit starts. Replace switch if needed.
Temperature fluctuations/ rapid cycling from hot to cold.	Undersized connectors/ water lines.	Increase size of connectors/ water lines.
	Long connecting lines between unit and mold.	Move the unit closer to the mold and shorten connecting lines.
	Serpentine flow through mold.	Connect lines for parallel flow instead of series flow.
	Blocked water line in mold.	Check mold for metal chips or lime buildup. Clean mold.
	Quick disconnect fitting with check valve.	Remove and replace fitting or valve.
	Lime buildup in unit piping.	Clean or replace.
	Faulty TCU.	Check unit by connecting ¾" line directly from delivery to return line. Run unit to determine if TCU controls set point temperature.
Unit overheats or does not cool.	Drain is plugged or excessive back pressure is in drain line.	Clear drain line or eliminate back pressure condition.
	Faulty solenoid valve.	Test solenoid valve by pressing **VENT** button and listen for valve operation. Replace if faulty.
	Controller Cool output relay open.	Replace output relay.
	Solenoid valve is not operating, but **COOL** LED is on.	Set process temperature to minimum and check for mag-netism on solenoid coil top.
	Solenoid coil circuit is open.	Check coil resistance. If MΩ range, replace solenoid coil.
	Modulating valve is not operating, but **OUT2** LED is on.	Set process temperature to minimum and check for complete travel of valve.
	Insufficient pressure differential between cooling **WATER IN** and **OUT** lines.	Find a means to get less back pressure in the **WATER OUT** line.
	Cooling valve is undersize.	Replace cooling valve with a larger valve.

Condition	Possible cause	Solution
Unit does not heat/cannot achieve set point.	Defective heater contactor.	Visually inspect coil and contacts; repair/replace defective contactors.
	Defective immersion heater.	Check resistance on all three (3) legs of the heater with an ohm meter. If not all equal, contact factory for replacement heater.
	Controller heat output open.	Check the heater output with an ohm meter to ground. It should read in the mega-ohm range. Infinite or zero readings indicate a defective output.
	Heater contactor is not energizing, but **HEAT** LED is on.	Set process temperature to maximum and check for control voltage at heater contactor.
	Immersion heater elements dirty.	Remove heater and clean elements.
	Immersion heater element is burned out.	Check heater tank for scorched/discolored paint. Check resistance on all three (3) legs of the heater with an ohm meter. Replace heater as required.
		Check for balanced amp draws, and supply voltage. If not present replace immersion heater.
	OUT1 indicator is on, but no voltage on heater contact.	Replace relay board on controller.
	Cooling valve is leaking.	Dismantle valve and clean out.
	Solenoid valve is not operating, but **COOL** LED is on.	Set process temperature to minimum and check for magnetism on top of solenoid coil.
	Magnetism on coil.	Clean coil.
	Faulty/dirty solenoid valve.	Press **VENT** button several times to flush the valve.
Relief valve leaks.	Foreign material under valve seat.	Manually open valve to clear seat of material.
	High system pressure.	Reduce **WATER IN** or **MAKEUP** water pressure.
Unit runs continuously cooling or heating, and cannot attain set point.	Unit under-sized for application.	Call sales representative.

Service Notes

Technical Assistance

Parts and Service Department

The ACS Customer Service Group will provide your company with genuine OEM quality parts manufactured to engineering design specifications, which will maximize your equipment's performance and efficiency. To assist in expediting your phone or fax order, please have the model and serial number of your unit when you contact us. A customer replacement parts list is included in this manual for your convenience. ACS welcomes inquiries on all your parts needs and is dedicated to providing excellent customer service.

For immediate assistance, please contact:

- North, Central and South America, 8am – 5pm CST +1 (800) 483-3919 for drying, conveying, heating and cooling and automation. For size reduction: +1 (800) 229-2919.
  North America, emergencies after 5pm CST (847) 439-5855
  North America email: acsuscanadacustserv@corpemail.com

- Mexico, Central & South America
  Email: acslatinamericacustserv@corpemail.com

- Europe, Middle East & Africa +48 22 390 9720
  Email: acseuropecustserv@corpemail.com

- India +91 21 35329112
  Email: acsindiacustserv@corpemail.com

- Asia/Australia +86 512 8717 1919
  Email: acsasiacustserv@corpemail.com

Sales and Contracting Department

Our products are sold by a worldwide network of independent sales representatives. Contact our Sales Department for the name of the sales representative nearest you.

Let us install your system. The Contract Department offers any or all of these services: project planning; system packages including drawings; equipment, labor, and construction materials; and union or non-union installations.

For assistance with your sales or system contracting needs please Call:
North, Central and South America +1 (262) 641-8600 or +1 (847) 273-7700
Monday–Friday, 8am–5pm CST

- Europe/Middle East/Africa +48 22 390 9720

- India +91 21 35329112

- Asia/Australia +86 512 8717 1919

Facilities:
ACS offers facilities around the world to service you no matter where you are located. For more information, please visit us at www.acscorporate.com

United States:

ACS Schaumburg-Corporate Offices
1100 E. Woodfield Road
Suite 588
Schaumburg, IL 60173
Phone: + 1 847 273 7700
Fax: + 1 847 273 7804

ACS New Berlin- Manufacturing Facility
2900 S. 160th Street
New Berlin, WI 53151
Phone : +1 262 641 8600
Fax: + 1 262 641 8653

Asia/Australia:

ACS Suzhou
109 Xingpu Road SIP
Suzhou, China 215126
Phone: + 86 8717 1919
Fax: +86 512 8717 1916

Europe/Middle East/Africa:

ACS Warsaw
Ul. Działkowa 115
02-234 Warszawa
Phone: + 48 22 390 9720
Fax: +48 22 390 9724

India

ACS India
Gat No. 191/1, Sandbhor Complex
Mhalunge, Chakan, Tal Khed,
Dist. Pune 410501, India
Phone: +91 21 35329112
Fax: + 91 20 40147576